Nazarbayev University School of Medicine

Master of Public Health

Identifying and measuring associations between dietary factors and the risk of developing gastric cancer in Astana, Kazakhstan: preliminary findings from an ongoing study

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Abstract

Objectives. Gastric cancer is one of the most common type of cancer in Kazakhstan as well as worldwide with high mortality and morbidity rate. The aim of the study is to identify and measure associations between nutritional risk factors and the risk of having gastric cancer in Astana, Kazakhstan.

Methods. Prospective cohort study has been chosen as a study design for this study. Patients coming to the Republican Diagnostic Center or Astana Oncology Center were recruited and provided with informed consent form and fifteen-minute survey, which included questions on their behavioral factors (alcohol consumption, smoking, physical activity, etc.), nutritional factors (consumption of salted, canned food, processed meat, preserved meat, pickled vegetables, fresh fruits and vegetables, etc.). In total, sample size was 39 participants from which 5 cases of gastric cancer, and 34 – other gastric diseases (gastritis, ulcer, etc.). Univariate and multivariate (adjusted for age) logistic regression were performed to measure the association between risk factors and gastric cancer.

Results. Bivariate test using logistic regression testing the association between risk factors and gastric cancer showed that factors such as sports time, consumption of processed meat, fresh fruit size, kazy consumption and pickled vegetables size were statistically significantly associated with the risk of having gastric cancer ($p<0.10$). However, when those variables were adjusted in multivariate logistic regression for age, none of the variables was significant, possibly, due to insufficient sample size.

Conclusion. Consumption of pickled vegetables, processed meat were found to be risk factors for gastric cancer while fresh fruit size and sports time were protective factors against gastric cancer. Based on the findings, it was recommended to reduce nutritional risk factors among citizens of Kazakhstan in order to reduce rates of gastric cancer mortality and morbidity.

1. Introduction

Development of cancerous cell inside the covering of the stomach is a characteristic of gastric cancer, which also can be called as stomach cancer. Gastric tumor is the second most prevalent cancer worldwide and 66 per cent of cases occur in developing countries. Among male, gastric cancer is the fourth most common cancer, whereas it is the fifth most common cancer among female worldwide. Gastric cancer remains one of the important public health problem and major cause of cancer mortality throughout the world, despite the fact that gastric cancer incidence is deteriorating [1, 2].

Other types of cancer that rarely can be occurred in the stomach include squamous, undifferentiated carcinomas and adenosquamous. Moreover, additional types of rare malignant tumors in the stomach can be hemangiopericytomas, choriocarcinomas, carcinoid tumors, and rhabdomyosarcomas. In addition, in association with the AIDS, Kaposi's sarcoma also has been reported [5].

Gastric cancer is one of the top diseases with high mortality and morbidity rate in Kazakhstan, 14.9 and 21.8, respectively [6, 7]. Gastric cancer is one of the leading oncological diseases alongside with cancer of the trachea, lungs, breast and skin in Kazakhstan. Among males, gastric cancer is ranked second after lung cancer, accounting for 11.8% from all the localizations [7].

In Kazakhstan, the prevalence of stomach cancer was 8.5% in the structure of malignant growth. From 2004 to 2013 there was 18 per cent decline of gastric cancer morbidity in Kazakhstan. Among age group 75-79 there was a peak of gastric cancer morbidity – 225.8 per 100,000 among males, and 90.3 per 100,000 among females [7].

Gastric cancer remains one of the major health problems in Kazakhstan despite the improvements made in oncology worldwide. Identification of risk factors of gastric cancer and improvement of treatment can reduce gastric cancer morbidity in Kazakhstan.

Risk factors

The major potential risk factors for gastric cancer are Helicobacter Pylori, alcohol consumption, smoking status, dietary factors, fruit and vegetables (protective factors), salted food, nitrite and nitrate (e.g. preserved meat), and others.

H. Pylori. In 1983, after Helicobacter pylori was announced by Marshall, an abundance of confirmation has been accumulated regarding microorganism and its part in gastric disease etiology [8]. The International Agency for Research on Cancer defined Helicobacter pylori in a causal relationship with cancer and classified it as carcinogenic in 1994 [9]. A number of studies including case-control studies, prospective cohort studies and ecological studies have confirmed causal associations between Helicobacter pylori and gastric cancer. Furthermore, countries with high prevalence of Helicobacter pylori typically have high rates of gastric cancer as it was provided by the international population study conducted by the Eurogast study group [10].

Dietary factors. The role of diet and its association with gastric cancer has been broadly researched among different socioeconomic groups in different countries. It showed conclusive results and that diet could play important role in etiology of gastric cancer [5].

Fruit and vegetables. It was hypothesized that micronutrients in fruits and vegetables can be protective against gastric cancer as it was shown in numerous studies; in addition, results were shown adjusted for other dietary patterns. Potential protective micronutrients in fruits and vegetables include vitamins such as ascorbate (C) and alpha-tocopherol (E), selenium, and beta-carotene (carotenoids) [11]. Among those micronutrients, the vitamin C has the strongest association as a protective factor against gastric cancer showing the difference between low intake and high intake in case-control study [12]. Nevertheless, the study performed in China, as a 5-year interventional trial, which involved 30,000 participants, aged 40-69 years in China, did not demonstrate any difference in the risk of development gastric cancer among participants receiving supplemental vitamin C [13].

Salt. The first hypothesis regarding the role of excess salt intake in the etiology of gastric cancer was demonstrated in 1965. It was suggested that constant salt intake in high doses can lead to development of atrophic gastritis, consequently increasing the risk of having gastric cancer [14]. Despite the fact that there are insufficient quantitative studies measuring the association between salt intake and the risk of developing gastric cancer, high salt consumption was continuously reported in various analytical and ecological studies as one of the risk factors for stomach cancer.

Nitrite and nitrate. In animal studies different compounds of N-nitroso have been reported as carcinogenic to humans. Those compounds are formed from nitrate or nitrite in the stomach. Therefore, it is hypothesized that consumption of food with high nitrate or nitrate can be associated with the risk of having stomach cancer. Preserved meats and vegetables are potential sources of nitrite and nitrate. In addition, nitrate is also contained in water but the amount of nitrite is insignificant [5].

Overall, everyday consumption of nitrate is higher 100 times than nitrite. Preformed components of N-nitroso may consist in some food including cured meat [11]. Different studies including case-control studies have shown that there was negative association between consumption of nitrate and the risk of developing gastric cancer. Moreover, those studies demonstrated that vegetable intake could reduce the risk of having stomach cancer. Since nitrate is contained in vegetables, it is not surprisingly that negative association was found between nitrate intake and the risk of gastric cancer [11].

Alcohol. Review performed in 1994 including different studies - ecological, descriptive, experimental and analytical studies have shown insignificant association between consumption of alcohol and the risk of developing stomach cancer [15]. More than 50 studies, cohort and case-control in design, showed negative results on association between alcohol and stomach cancer, thus, it was concluded that consumption of alcohol could not be potentially involved in the etiology

of gastric cancer. Another four case-control studies did not show that the association exists between alcohol consumption and the risk of having gastric cancer [16-19].

Smoking. Studies on the association between smoking and stomach cancer showed inconclusive results; among them, some of the studies showed weak and moderate associations while some of the studies showed no associations [20, 21]. Studies that found an association between smoking and the risk of stomach cancer showed only less than twofold relative risk, few studies showed dose-response association [22, 23]. One of the limitation of those studies is that they lacked control for confounding of factors such as Helicobacter pylori positively associated with smoking.

Rationale of the study

The purpose of the study is to determine and measure the association between dietary factors such as consumption of smoked, processed food, etc. and the risk of developing gastric cancer in Astana in order to inform the development of policies to decrease the risk of having gastric cancer.

There are no studies in Kazakhstan measuring the association between nutritional factors and risk of developing gastric cancer. Previous studies on gastric cancer provides descriptive information regarding the prevalence of gastric cancer, without testing its major risk factors (24, 25). Therefore, this study will be helpful in providing evidence-based results regarding the association between dietary factors and the risk of having gastric cancer to develop effective interventions and policies with the aim of decreasing incidence of gastric cancer, its morbidity and mortality rate.

Aims of the study

1. Identify and measure associations between dietary factors and the risk of developing gastric cancer in Astana, Kazakhstan;

2. To recommend further interventions and policies in order to reduce rate of gastric cancer.

2. Methods

2.1 Study design

Prospective cohort study design has been chosen to identify and measure association between dietary factors and the risk of developing gastric cancer. Patients coming to the one Republican Diagnostic center (RDC) or Astana Oncology Center took survey before they were diagnosed.

2.2 Study population

Adults over the age of 18 coming with complaints for gastric diseases to RDC and Astana Oncology Center participated in the study. Patients with mental illness, age less than 18, critically diseased patients were exclusion criteria. Consent forms – for medical record access and for taking part in a survey were provided to potential participants. Interviewers explained to patients about their rights to skip some of the questions or refuse from participation and confidentiality terms.

2.3 Data collection

Demographic information such as names, age, sex, occupation, place of residence, health data such as diagnosis, date of diagnosis, cancer stage were extracted on-site from patient records in hospitals that conduct gastric cancer diagnostics, treatment and surgeries. A fifth teen minute

survey was conducted on potential gastric cancer determinants and risk factors. Patients who are undergoing diagnostic gastroesophageal endoscopies without prior diagnosis of stomach cancer have been provided with an information consent form prior enrollment. Patients diagnosed with gastric cancer who are currently undergoing treatment at these hospitals were not included in the study. The same survey, with the provision of consent, was conducted with endoscopic patients. Based on histological findings from gastroscopic biopsy, patients were allocated to case or non-case groups.

2.4 Study variables

Dependent variable was the diagnosis including histologically confirmed gastric cancer and any other gastric diseases such as gastritis, gastroesophageal reflux disease, ulcer, etc., whereas independent variables were potential risk and protective factors – demographic variables (age, residence, occupation, ethnicity), health data (blood group, Helicobacter pylori), behavioral factors (physical activity, consumption of alcohol, smoking status, etc.), dietary factors (consumption of salted, canned food, preserved meat, fresh fruits and vegetables, pickled vegetables, etc.).

2.5 Data analysis

Univariate analysis was performed to estimate the prevalence of gastric cancer, in addition, the rate of consuming dietary patterns such as salted food, processes meat, canned food, fruits and vegetables, etc. Bivariate tests such as chi-square, Fisher's exact test were used to measure the association between nutritional factors and the risk of gastric cancer, as well as different potential risk factors such as alcohol consumption, smoking, physical activity, demographic characteristics, etc. Multivariate logistic regression have been performed for identifying association between the variable of interest, which is dietary factors, and outcome variable, which is gastric cancer, adjusting for other variables using statistical software STATA 12 (13).

3. Results

The Table-1 below demonstrates descriptive statistics on demographic information such as age, ethnicity, sex, behavioral factors such as alcohol consumption, smoking, physical activities, nutritional factors such as consumption of salted food, snacks, processed meat, canned food, etc.

It can be seen from the Table-1 that average age among participants was 53, with 62.5% of female and 37.5% male. In total, sample size consisted of 39 participants, in which five were cases of gastric cancer, and 34 were those who had other gastric diseases.

Table-1. Descriptive statistics (total number and frequency) among cases (histologically confirmed gastric cancer) and non-cases (gastric diseases).

Variable	Total (%)	Cases (%)	Non-cases (%)
Mean Age	53.87±17.37	65.8±20.09	50.17±16.09
Sex			
Female	25 (62.50%)	3 (60%)	20 (60.61%)
Male	15 (37.50%)	2 (40%)	13 (39.39%)
Ethnicity			
Kazakh	32 (82.05%)	4 (80%)	26 (81.25%)
Other	7 (17.95%)	1 (20%)	6 (18.75%)
Diagnosis			
Gastric cancer	5 (12.82%)		
Gastritis	18 (46.15%)		
Other	16 (41.03%)		
Current smoking status			
Daily	4 (10.81%)	0	3 (9.38%)

Less than daily	1 (2.70%)	1 (20%)	1 (3.13%)
Don’t smoke	32 (86.49%)	4 (80%)	28 (87.5%)
Past smoking status			
Daily	2 (6.90%)	0	2 (8.33%)
Less than daily	6 (20.69%)	0	6 (25%)
Don’t smoke	21 (72.41%)	5 (100%)	16 (66.67%)
Smoke shisha			
Less than daily	3 (8.57%)	0	3 (10.0%)
Don’t smoke	32 (91.43%)	5 (100%)	27 (90.0%)
Kumys/Shubat frequency			
Never			
1 time per month or less	13 (34.21%)	1 (20%)	12 (36.36%)
2-3 times per month	14 (36.84%)	1 (20%)	13 (39.39%)
1-2 times per week	6 (15.79%)	2 (40%)	4 (12.12%)
4-5 times per day	2 (5.26%)	0	2 (6.06%)
3-4 times per week	1 (2.63%)	0	1 (3.03%)
	2 (5.26%)	1 (20%)	1 (3.03%)
Kumys/Shubat size			
Less than 1 regular size tea cup	12 (50%)	3 (75%)	9 (45%)
1 to 3 regular size tea cup	11 (45.83%)	1 (25%)	10 (50%)
More than 3 regular size tea cup	1 (4.17%)	0	1 (5%)
Alcohol frequency			
1 time per month or less	12 (32.43%)	0	12 (37.5%)
1-2 times per week	1 (2.70%)	0	1 (3.13%)

2-3 times per month	4 (10.81%)	0	4 (12.5%)
Never	20 (54.05%)	5 (100%)	15 (46.88%)
Alcohol size			
Less than 1 regular size (beer bottle or can, a glass of wine or vodka/cognac/whisky)	5 (33.33%)		5 (33.33%)
1 to 3 regular size	10 (66.67%)		10 (66.67%)
Sports time			
None	15 (39.47%)	4 (80%)	11 (33.33%)
Less than 15 mins	11 (28.95%)	1 (20%)	10 (30.3%)
15-30 mins	4 (10.53%)		4 (12.12%)
30 min – 1 hour	5 (13.16%)		5 (15.63%)
1-2 hours	2 (5.26%)		2 (6.06%)
More than 2 hours	1 (2.63%)		1 (3.03%)
Processed meat frequency			
Never			
1 time per month or less	6 (15.79%)	0	6 (18.18%)
2-3 times per month	10 (26.32%)	0	10 (30.3%)
1-2 times per week	6 (15.79%)	1 (20%)	5 (15.15%)
3-4 times per week	10 (26.32%)	1 (20%)	9 (27.27%)
5-6 times per week	3 (7.89%)	2 (40%)	1 3.03%
1 time per day	1 (2.63%)	1 (20%)	0
	2 (5.26%)	0	2 (6.06%)
Processed meat size			
Less than 100 gr	12 (36.36%)	3 (60%)	9 (32.14%)

100 to 300 gr	19 (57.58%)	2 (40%)	17 (60.71%)
More than 300 gr	2 (6.06%)	0	2 (7.14%)
Kazy frequency			
Never	3 (7.89%)	0	3 (9.09%)
1 time per month or less	14 (36.84%)	0	14 (42.43%)
2-3 times per month	8 (21.05%)	1 (20%)	7 (21.21%)
1-2 times per week	7 (18.42%)	3 (60%)	4 (12.12%)
3-4 times per week	2 (5.26%)	0	2 (6.06%)
5-6 times per week	1 (2.63%)	0	1 (3.03%)
1 time per day	3 (7.89%)	1 (20%)	2 (6.06%)
Kazy size			
Less than 100 gr	22 (64.71%)	3 (60%)	19 (65.52%)
100 to 300 gr	11 (32.35%)	2 (40%)	9 (31.03%)
More than 300 gr	1 (2.94%)	0	1 (3.45)
Pickled vegetables frequency			
Never			
1 time per month or less	1 (2.70%)	0	1 (3.13%)
2-3 times per month	16 (43.24%)	1 (20%)	15 (46.88%)
1-2 times per week	6 (16.22%)	1 (20%)	3 (9.38%)
3-4 times per week	6 (16.22%)	1 (20%)	5 (15.63%)
1 time per day	3 (8.11%)	2 (40%)	1 (3.13%)
2-3 times per day	1 (2.70%)	0	1 (3.13%)
4-5 times per day	3 (8.11%)	0	3 (9.38%)
	1 (2.70%)	0	1 (3.13%)
Pickled vegetables size			
	13 (37.14%)	4 (80%)	9 (30.0%)

Less than 1 regular-size pickled vegetable	21 (60.0%)	1 (20%)	20 (66.67%)
1 to 3 regular-size pickled vegetable	1 (2.86%)	0	1 (3.33%)
More than 3 regular-size pickled vegetable			
Salted snack frequency			
Never	17 (45.95%)	4 (80%)	13 (40.63%)
1 time per month or less	9 (24.32%)	1 (20%)	8 (25.0%)
2-3 times per month	6 (16.22%)	0	6 (18.75%)
1-2 times per week	5 (13.51%)	0	5 (15.63%)
Salted snack size			
Less than 1 regular package	14 (77.78%)	1 (100%)	13 (76.47%)
1 to 3 regular packages	3 (16.67%)	0	3 (17.65%)
More than 3 regular packages	1 (5.56%)	0	1 (5.88%)
Smoked food frequency			
1 time per day	1 (2.70%)	0	1 (3.13%)
1 time per month or less	16 (43.24%)	3 (60%)	13 (40.63%)
1-2 times per week	3 (8.11%)	0	3 (9.38%)
2-3 times per month	6 (16.22%)	2 (40%)	4 (12.5%)
Never	11 (29.73%)	0	11 (34.38%)
Smoked food size			
Less than 100 gr	15 (62.5%)	3 (60%)	12 (63.16%)
100 to 300 gr	9 (37.5%)	2 (40%)	7 (36.84%)

Canned food frequency			
1 time per month or less	16 (44.44%)	2 (40%)	14 (45.16%)
1-2 times per week	2 (5.56%)	0	2 (6.45%)
2-3 times per month	3 (8.33%)	0	3 (9.68%)
Never	15 (41.67%)	3 (60%)	12 (38.71%)
Canned food size			
Less than 1 regular size can	20 (95.24%)	2 (100%)	18 (94.74%)
1 to 3 regular size cans	1 (4.76%)		
		0	1 (5.26%)
Fresh vegetables frequency			
1 time per month or less			
2-3 times per month	1 (2.78%)	0	1 (3.23%)
1-2 times per week	4 (11.11%)	0	4 (12.9%)
3-4 times per week	11 (30.56%)	3 (60%)	8 (25.81%)
1 time per day	11 (30.56%)	1 (20%)	10 (32.26%)
2-3 times per day	2 (5.56%)	0	2 (6.45%)
5-6 times per week	2 (5.56%)	0	2 (6.45%)
	5 (13.89%)	1 (20%)	4 (12.9)
Fresh vegetable size			
Less than 1 plate	28 (80.0%)	5 (100%)	23 (76.67%)
1 to 3 plates	7 (20.0%)	0	7 (23.33%)
Fresh fruit frequency			
1 time per month or less	1 (2.78%)	1 (20%)	0
2-3 times per month	5 (13.89%)	1 (20%)	4 (12.9%)
1-2 times per week	10 (27.78%)	1 (20%)	9 (29.03%)
3-4 times per week	11 (30.56%)	1 (20%)	10 (32.26%)

1 time per day	7 (19.44%)	1 (20%)	6 (19.35%)
2-3 times per day	1 (2.78%)	0	1 (3.23%)
4-5 times per day	1 (2.78%)	0	1 (3.23%)
Fresh fruit size			
Less than 1 regular sized fruit	9 (25.0%)	3 (75%)	6 (18.75%)
1 to 3 regular sized fruit	21 (58.33%)		
More than 3 regular sized	6 (16.67%)	1 (25%)	20 (62.5%)
fruit		0	6 (18.75%)
Water type			
Piped water	12 (33.33%)	2 (40%)	10 (32.26%)
Bottled water	21 (58.33%)	2 (40%)	19 (61.29%)
Well water	1 (2.78%)	1 (20%)	1 (3.23%)
Spring water	2 (5.56%)		2 (6.46%)
Cooking source			
Electric stove	15 (71.43%)	1 (100%)	14 (85.0%)
Gas stove	6 (28.57%)	0	6 (15.0%)
Family Cancer			
Yes	14 (40.0%)	2 (40%)	12 (40.0%)
No	21 (60.0%)	3 (60%)	18 (60.0%)

Table-2 shows multivariate logistic regression between independent and dependent variables. In simple logistic regression factors such as kazy frequency, sport time, fresh fruit were statistically significant predictors for the outcome variable, which is histologically confirmed gastric cancer. However, when these variables were adjusted for age in multivariate logistic regression, it showed insignificant p-value. Due to insufficient sample size, in multivariate logistic regression the model was adjusted only for one variable – age, which is universal confounding

factor. In addition, the Hosmer-Lemeshow goodness of fit test showed that the model does not fit well, when the model was adjusted for more than one variable.

According to the results of bivariate test using logistic regression, sports time was statistically significantly associated with the risk of having gastric cancer, as significance level was 10% in bivariate analysis. Those who have physical activity more than 30 minutes per day have 0.12 times lower odds of getting gastric cancer than those who have physical activity less than 30 minutes per day ($p<0.10$). Another significant predictor for gastric cancer is frequency of consuming processed meat – consuming processed meat increases the risk of having gastric cancer 7 times compared to never consuming processed meat ($p<0.10$).

Frequency of kazy consumption was also statistically significantly associated with the probability of getting gastric cancer. Those who consume kazy 1-2 times per week have increased risk of having gastric cancer 18 times than those who consume kazy one time per month or less. The size of pickled vegetable was significant protective factor from having gastric cancer – those who usually consume more than 100 gr of pickled vegetable have 0.14 times lower risk of getting gastric cancer than those who usually consume less than 100 gr of pickled vegetable. Fresh fruit size was also statistically significant protective factor against gastric cancer – consuming more than one regular fruit decreases the risk of getting gastric cancer compared to consuming less than one regular fruit.

Statistically significant predictors in bivariate analysis were put in multivariate logistic regression adjusting for age. However, due to insufficient sample size, none of the variables was significant; some of the variables such as frequency of kazy consumption and fresh fruit size were on the borderline of significance level. It is possible that those variables could be significant in multivariate logistic regression in case of having adequate sample size.

	OR (95% CI)	p-value	$OR_{adjusted}$ (95% CI)	$p\text{-value}_{adjusted}$
Current Smoke				
Don't smoke	Reference		Reference	
Smoke	1.81 (0.15-20.54)	0.631	13.95 (0.15- 1223.23)	0.248
Kumys/Shubat				
frequency				
No	Reference			
Yes	4.69 (0.66-32.22)	0.122	3.07 (0.33-27.88)	0.319
Kumys/Shubat size				
Less than 1 regular cup	Reference		Reference	
1 and more regular cup	1.82 (0.28-11.84)	0.528	0.45 (0.03-6.19)	0.548
Sports time				
No	Reference		Reference	
Yes	0.12 (0.01-1.26)	0.077*	0.16 (0.01-1.92)	0.150
Processed meat				
frequency				
No	Reference		Reference	
Yes	7 (0.69-70.04)	0.098*	7.63 (0.64-89.62)	0.106
Processed meat size				
Less than 100 gr				

More than 100 gr	Reference		Reference	
	0.49 (0.07-3.34)	0.468	0.53 (0.06-4.39)	0.560
Kazy frequency				
No (1 time per month or less)	Reference		Reference	
1-2 times per week	18 (1.48-218.95)	0.023*	12.57 (0.81-195.02)	0.070
More than 3 times per week	4.8 (0.26-90.29)	0.295	4.71 (0.20-109.78)	0.334
Kazy size				
Less than 100 gr	Reference			
More than 100 gr	1.53 (0.22-10.64)	0.665	1.56 (0.18-13.25)	0.684
Pickled Vegetables				
Frequency				
No	Reference		Reference	
Yes	3 (0.44-20.67)	0.265	2.05 (0.23-18.36)	0.521
Pickled vegetable size				
Less than 100 gr	Reference		Reference	
More than 100 gr	0.14 (0.01-1.43)	0.098*	0.16 (0.01-1.92)	0.149
Smoked Food				
Frequency				
No	Reference		Reference	
Yes	2.08 (0.29-14.77)	0.463	1.44 (0.15-13.55)	0.751
Smoked Food Size				
Less than 100 gr	Reference		Reference	
More than 100 gr	2.48 (0.34-17.83)	0.368	3.54 (0.35-35.47)	0.283

Canned Food				
Frequency				
No	Reference		Reference	
Yes	0.49 (0.07-3.34)	0.468	0.61 (0.07-4.99)	0.646
Fresh Vegetables				
Frequency				
No	Reference		Reference	
Yes	0.56 (0.08-3.77)	0.548	0.48 (0.06-3.99)	0.500
Fresh Fruit				
Frequency				
No	Reference		Reference	
Yes	0.33 (0.05-2.45)	0.281	0.27 (0.03-2.78)	0.272
Fresh Fruit Size				
Less than 1 regular fruit	Reference		Reference	
More than 1 regular fruit	0.07 (0.01-0.70)	0.024*	0.10 (0.01-1.29)	0.078
Water type				
Well/Spring	Reference		Reference	
Piped/Bottled	0.55 (0.05-6.25)	0.631	0.53 (0.03-10.59)	0.678
Family cancer				
No	Reference		Reference	
Yes	1.16 (0.17-7.99)	0.875	0.96 (0.12-7.91)	0.973

4. Discussion

The results of the study regarding the risk and protective factors for gastric cancer were consistent with previous studies that found associations between factors such as consumption of pickled vegetables, fresh fruits, physical activity and the risk of having gastric cancer [5, 11-13]. Furthermore, the study presented new findings regarding the association between consumption of kazy and the risk of gastric cancer, therefore, further research is needed on specific features of kazy, its characteristics, concentration of salt, concentration of N-nitroso compounds and others.

The major limitation of the study is that there was insufficient sample size, thus, it did not allow finding more statistically significant predictors associated with the risk of having gastric cancer. However, since this is a preliminary finding from an ongoing study, the study will be continued in order to have larger sample size. Larger sample size will allow analyzing additional major behavioral risk factors such as consumption of alcohol, smoking and others, since in this stage there was no cases of consuming alcohol or smoking among those who had a stomach cancer.

The strength of the study is the study design, which is prospective cohort study comparing cases and non-cases whilst majority of the studies performed in Kazakhstan provided only descriptive statistics on prevalence or incidence of the gastric cancer among Kazakhstani citizens. It did not allow identifying and measuring the association between risk and protective factors and gastric cancer in Kazakhstan.

5. Conclusion

The study will be continued in order to obtain adequate sample size, which allow to analyze predictors in multivariate logistic regression. In addition, data collection locations will be expanded to another oncology centers in order to have more cases of gastric cancer. Larger sample

size can provide analysis of additional risk factors such as smoking and alcohol consumption. Finally, the findings of the study can provide evidence-based results for reducing nutritional risk factors in Kazakhstan.

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